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In the following table the minutes after sunset, or abscissas, and the percentage of light as compared with sunset, or ordinates, are given, from which the last curve was constructed:—

TABLE III.

Minutes after Sunset.	Per cent of Light compared with Sunset.	Minutes after Sunset.	Per cent of Light.
0	1.000	18	.094
1	.950	19	.079
2	.817	20	.064
3	.752	21	.055
4	.655	22	.044
5	.597	23	.038
6	.516	24	.031
7	.466	25	.026
8	.407	26	.021
9	.337	27	.015
10	.290	28	.012
11	.261	29	.010
12	.228	30	.009
13	.200	31	.007
14	.177	32	.006
15	.143	33	.005
16	.123	34	.004
17	.101		

IV.—LIGHT OF THE SKY.

By W. O. CROSBY.

THE light of the sky is reflected light, of which the sun is the source.

It is well known that the light of the sky diminishes as the angular distance from the sun increases. And the following observations were made with a view, first, to determine the absolute amount of light received from the sky at different distances from the sun; secondly, to ascertain the law of the diminution of the light with increasing angular distance from the sun. The apparatus employed consisted of a common mirror, so arranged as to reflect the light horizontally into a darkened room, a condensing lens having an aperture of 9 cm. and a focal distance of 225 cm., and a photometer similar to that employed by Dr. Williams in his observations on twilight.

The method pursued was to so adjust the mirror and lens that an image of the sun would fall upon the disk of the photometer, and then

to measure the intensity of the light at regular intervals of time as the sun receded from the portion of sky from which the light was received.

By allowing the mirror to remain fixed during an entire series of observations, absolute uniformity in the angle of incidence of the light on the mirror was obtained, and thus the percentage of the light reflected by the mirror rendered constant, and exact measurements of the angular distance from the sun could be easily made by simply noting the lapse of time.

One result of this method is that all the observations are made east of the sun; the part of the sky from which the light is received being necessarily on the sun's path. A reverse series can be readily obtained on the west side of the sun, by adjusting the mirror so as to receive light from a point at a convenient distance west of the sun, on the path of the same, and then making observations at regular intervals as the sun approaches the point.

The light was received from a circular sky area, $2^{\circ} 20'$ in diameter, or 4.25 square degrees; and the proportion of the light lost by reflection from the mirror, and transmission through the lens, was about .40 of the whole. The following table embraces the results of four series of observations. Column one gives the angular distance from the sun. The second, third, fourth, and fifth columns give the intensity of the light received from one square degree of sky; the unit of intensity being the light of a standard candle at a distance of one metre. Series I. was made Jan. 20, 1875, between the hours of 2.45 and 3.47 P.M., beginning $15^{\circ} 45'$ west of the sun. The declination of the sun at this time was 20° ; and, since the angles given in the table for this series were not measured on a great circle, they should be reduced in the proportion of the radius to the cosine of the declination. Series II., III., and IV. were made east of the sun between 12 M. and 1 P.M.; the II. on March 23, the III. and IV. on March 27.

On Jan. 20, the sky was hazy, had a whitish-gray aspect, and reflected much light; on the 23d of March it was clear and blue; and on the 27th very clear, reflecting but little light. The great difference in the intensity of the light on these different days is well shown by comparing columns two, three, four, and five of the table.

The meteorological importance of such observations as these is suggested by the fact that it is commonly believed that a deep blue sky, reflecting little light, indicates the presence of a large amount of the vapor of water in the atmosphere, and the probable approach of rain, and that a very clear night frequently precedes a rainy day. If

it can be proved that such a relation exists between the relative moisture of the upper atmosphere and the light of the sky, it is evident that we have here a hygrometer with a widely extended range.

Sun's Dist.	I.	II.	III.	IV.	1.	2.	3.	4.	Mean.
0°30'		28.70	12.61	9.41		— 3.8	+ 5.5	—19.0	— 0.1
0 45	75.80	17.41	6.75	7.28	—15.2	+ 3.0	— 5.2	+ 6.4	+ 1.4
1		13.71	5.15	4.61		+22.0	+ 6.7	— 5.2	+ 7.8
1 15	61.16	7.88	3.83	3.53	— 4.8	— 4.3	+ 4.7	— 6.4	— 2.0
1 30		5.63		3.00		—12.5		— 0.0	— 6.2
1 45	47.33	4.70	2.53	2.37	— 1.8	— 8.2	+ 9.0	— 4.5	— 1.2
2		4.28	1.87	1.78		+ 1.9	— 4.0	—25.3	— 9.1
2 15	40.00	3.45	1.58	1.51	— 3.3	— 3.3	— 5.5	—21.7	— 8.4
2 30		2.87		1.37		— 6.4		—16.5	—11.4
2 45	34.26	2.41	1.15	1.23	+11.2	—10.2	—10.4	—15.0	— 6.1
3 15	27.16	2.05	1.01	1.07	+10.5	— 1.7	— 1.9	— 9.6	— 0.6
3 45	20.00	1.61	.83	.98	— 1.0	— 5.7	— 2.1	+ 0.0	— 2.2
4 15	17.66	1.50	.75	.88	— 2.4	+ 6.0	+ 4.3	+ 4.7	+ 3.1
4 45	14.75	1.33	.65	.83	+ 1.0	+ 9.7	+ 4.3	+12.3	+ 6.8
5 15	13.50	1.17	.60		+ 6.4	+11.5	+ 9.7		+ 9.2
5 45	11.33	1.10	.55	.72	+ 1.9	+18.6	+13.3	+23.1	+14.2
6 15	9.50				— 4.7				— 4.7
6 45	8.48			.60	— 5.2			+24.5	— 1.4
7 15	6.80			.56	—19.4			+26.8	+ 3.7
7 45	6.58			.52	—12.3			+23.0	+ 8.4
8 15	6.21				— 9.0				— 9.0
8 45	5.45				—13.8				—13.8
9 15	5.13				—12.3				—12.3
9 45	4.93				— 8.0				— 8.0
10 15	4.70				— 6.2				— 6.2
10 45	4.93				+ 5.7				+ 5.7
11 15	4.60				+ 4.7				+ 4.7
11 45	4.30				+ 1.6				+ 1.6
12 15	4.15				+ 6.4				+ 6.4
12 45	3.90				+ 6.5				+ 0.5
13 15	3.71				+ 6.7				+ 6.7
13 45	3.47				+ 4.5				+ 4.5
14 15	3.10				— 1.4				— 1.4
14 45	2.90				— 4.0				— 4.0
15 15	2.80				— 3.0				— 3.0
15 45	2.71				— 1.4				— 1.4

A curve has been constructed for each series of observations, having intensities as ordinates and natural sines of the sun's angular distances as abscissas; and an inspection of these curves shows a close agreement in their forms, which indicates that, notwithstanding the great differences in the intensity of the light, its variations followed the same, or nearly the same law, in each case. Other curves were constructed, with co-ordinates equal to the logarithms of the co-ordinates of the curves just mentioned, which show by their approximation to straight lines that the law of the variation of the light may be expressed by

the equation $y = mx^n$, the light being proportional to some power of the sun's angular distance.

The most noticeable deviation from a straight line is in the curve for series I. where it approaches the axis of y ; here the intensities are less than required by a straight line, which is explained by the fact that this series was made late in the afternoon of a winter day when the light of the sun itself was rapidly diminishing, and, as before stated, the observations nearest the sun were made last.

Neglecting, for the reason just given, the first three observations of series I., we obtain the following as the most probable values of n in each case: series I. — 1.4; II. — 1.4; III. — 1.32; IV. — 1.21. Computing now the numerical value of m for each series, and substituting in the equation $y = mx^n$, we have for series: I. $y = 359x^{-1.4}$; II. $y = 33.1x^{-1.4}$; III. $y = 13.7x^{-1.32}$; IV. $y = 12.6x^{-1.21}$.

Columns 1, 2, 3, and 4 give the deviations from the formulæ of the observations of series I., II., III., and IV. respectively; the deviations being expressed in percentages of the intensities. The last column gives the mean of the deviations; neglecting, as before, the first three observations of series I. Although some of the deviations are quite large, yet the sums of the positive and negative deviations are approximately equal; and it will be observed that they frequently change their sign, which shows a close agreement with theory. It is probable that the larger deviations are attributable in part, at least, to sudden changes in the reflecting power of the sky, such as would be produced by air currents or by the precipitation or dissipation of atmospheric moisture.

That these deviations are greater than those due to errors of observation, is clearly shown by the experiments in the preceding article.

V.—LIGHT ABSORBED BY THE ATMOSPHERE OF THE SUN.

BY E. C. PICKERING AND D. P. STRANGE.

THE following series of experiments were made for the purpose of determining the relative amount of light received from portions of the sun's surface at varying distances from the centre of its disk. For this purpose, the sun's rays were reflected into a darkened room by means of the black glass mirror of a *porte-lumière*, and an image of the sun, 40 cms. in diameter, was, by means of a small telescope, thrown upon a screen placed at a distance of 230 cms. from the aperture. In the